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 (54) POLYCARBONATE MOLDING COMPOUNDS FOR PRODUCING ARTICLES WITH REDUCED DUST ATTRACTION

(57) The invention relates to polycarbonate molding compounds for synthetic articles which contain at least one antioxidant and one mold release agent and which have a reduced tendency to attract dust.



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(54) Title: POLYCARBONATE MOLDING COMPOUNDS FOR PRODUCING ARTICLES WITH REDUCED DUST  
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Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.



A1

(54) Title: POLYCARBONATE MOLDING COMPOUNDS FOR PRODUCING ARTICLES WITH REDUCED DUST ATTRACTION

WO 00/73386

(54) Bezeichnung: POLYCARBONATFORMMASSEN ZUR HERSTELLUNG VON ARTIKELN MIT VERMINDERTER STAUBANLAGERUNG

(57) Abstract: The invention relates to polycarbonate molding compounds for synthetic articles which contain at least one antioxidant and one mold release agent and which have a reduced tendency to attract dust.

(57) Zusammenfassung: Die Erfindung betrifft transparente Polycarbonatformmassen für Kunststoffartikel, die mindestens ein Antioxidant und ein Entformungshilfsmittel enthalten und die eine geringere Tendenz zu Staubanlagerung aufweisen.

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**Polycarbonate moulding compositions for the production of articles which exhibit a reduced take-up of dust**

This invention relates to transparent polycarbonate moulding compositions for plastics 5 articles, which contain at least one thermal stabiliser and a demoulding agent and which exhibit a reduced tendency to attract dust.

The take-up of dust on plastics mouldings is a very widespread problem; see, for example, Saechting, Kunststoff-Taschenbuch, 26th Edition, Hanser Verlag, 1995, 10 Munich, in this respect. Deposition of dust occurs, for example, when injection moulded bodies are stored under industrial conditions. Dust deposits on transparent mouldings are particularly troublesome and restrict the function thereof. One important industrial thermoplastic is polycarbonate. This is used in transparent forms, for example in the field of optical data storage media, in electrical engineering, in 15 automobile construction, in the building sector, for liquid containers and for other optical applications. For all these applications of polycarbonate the take-up of dust is undesirable and can impair the function thereof.

One known method of reducing the deposition of dust on plastics bodies is to use 20 antistatic agents. Anti-static agents for thermoplastics are described in the literature (see, for example, Gächter, Müller, Plastic Additives, Hanser Verlag, Munich, 1996, page 749 et seq.), which restrict the deposition of dust. These antistatic agents improve the electrical conductivity of plastics moulding compositions and thus dissipate surface charges which are formed during production and in use. Dust 25 particles are thus no longer attracted in increasing amounts, and consequently there is less take-up of dust.

A distinction is made here between internal and external antistatic agents. An external antistatic agent is deposited on the plastics material after processing, whereas an 30 internal antistatic agent is used as an additive during processing. For economic reasons, it is generally desirable to employ internal antistatic agents, since no further operations are necessary after processing for the deposition of the antistatic agent. For

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transparent forms of polycarbonate, however, there is currently no known internal antistatic agent which effectively restricts the take-up of dust and which at the same time does not impair the advantageous properties of this material, such as its high transparency, low haze and high impact strength.

5

One disadvantage of adding antistatic agents is that they increase the production cost of an article, as does any additive which is used. Therefore, it would generally be desirable to be able to employ as few additives (number and amount) as possible.

10 Moreover, for reasons of aesthetics, the patterns of the dust formations are of great importance. With moulding compositions which have been customary hitherto, unwanted tree-like structures often occur, as do round structures with dimensions of 1-20 mm. Intricate dust formations such as these strongly attract the eye, because they result in a strong contrast between dust-covered locations and locations which are  
15 almost dust-free. It would be desirable for moulding compositions to exist which either result in sheet-like dust formations on the surface or which cover the latter as uniformly as possible.

Surprisingly, suitable combinations of additives have been identified, by means of  
20 which the take-up of dust as a whole can be considerably restricted, and moreover with which intricate dust formations can substantially be prevented. The addition of antistatic agents can thus be dispensed with.

This object has been achieved according to the invention by a thermoplastic moulding  
25 composition which contains polycarbonate as an amorphous thermoplastic polymer, and which contains at least one thermal stabiliser and a demoulding agent, wherein the thermal stabiliser contains at least one stabiliser from the group comprising

- TPP, tetrakis(2,4-di-*tert*-butylphenyl)-4,4'-biphenylene diphosphonite, Irganox®  
30 1222, octadecyl-3-(3',5'-di-*tert*-butyl-4'-hydroxyphenyl) propionate, Irganox® HP2921, Anox® TB331, Anox® TB 123 or a mixture thereof, preferably in

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amounts between 0.001 and 1 % by weight, most preferably between 0.01 and 0.1 % by weight,

and the demoulding agent contains at least one substance from the group comprising

5

- polyols which are completely or partially esterified with a linear or branched fatty acid,

wherein glycerol, ethylene glycol, propylene glycol, pentaerythritol or fatty alcohols  
10 are preferably used as polyols.

Demoulding agents which are suitable according to the invention include the following compounds:

mono- and polyesters of glycerol, of pentaerythritol, of dipentaerythritol or of  
15 tripentaerythritol, or of diols such as 1,3-propanediol or 1,2-ethanediol, with branched or unbranched carboxylic acids which comprise 1-30 carbon atoms and which can also be completely or partially fluorinated.

Carboxylic acids which are particularly preferred include fatty acids, such as stearic  
20 acid or palmitic acid, as well as mixtures thereof. Unsaturated fatty acids can optionally also be hydrogenated or epoxidised.

Oligo- or poly-ethylene oxides or oligo- or poly-propylene oxides, which are modified by terminal groups, or copolymers or oligomers thereof, are also preferred. Suitable  
25 terminal groups include branched or unbranched carboxylic acids which comprise 1-30 carbon atoms and which may also be completely or partially fluorinated.

Substances which are also preferred are mono- and polyesters of di- and polycarboxylic acids with branched or unbranched alcohols comprising 1-30 carbon  
30 atoms, which may also be completely or partially fluorinated. Esters of trimellitic acid are preferred here.

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Demoulding agents which are quite particularly preferred include glycerol monostearate (GMS), triglycerides such as Grinstedt® PS102 (Danisco, Braband, Denmark), pentaerythritol tetrastearate (PETS), polyol fatty acid esters such as Loxiol® EP218 (Henkel KGaA, Düsseldorf, Germany), isocetyl stearyl stearate, 1,3-propanediol esterified with a natural fatty acid, such as Grinstedt® PGMS SPV (Danisco, Braband, Denmark), as well as epoxidised oils such as soya oil or linseed oil, which can be obtained under the trade names Edenol® B35 and B316 from Henkel KGaA, Düsseldorf, Germany, as well as trimellitic acid esters of monocarboxylic acids, such as Edenol® W310S supplied by Henkel KGaA, Düsseldorf, Germany.

Moreover, mixtures of the surface-active substances described above are quite particularly preferred.

The demoulding agents are preferably each used in amounts between 0.001 % by weight and 5 % by weight, preferably between 0.01 % by weight and 1 % by weight, more preferably between 0.1 and 1 % by weight, and most preferably between 0.2 and 0.6 % by weight.

Antioxidants which are suitable according to the invention are described in EP 0 839 623 A1 and EP 0 500 496 A, for example.

Substances which are particularly suitable in this respect include triarylphosphines, such as triphenylphosphine (TPP) for example, or aromatic phosphines which are substituted with linear or branched alkyl chains comprising 1-30 C atoms. Substances which are also suitable include aliphatic or aromatic phosphites such as tris(2,4-di-*tert*.butyl-phenyl) phosphite, hindered phenols such as octadecyl-3-(3',5'-di-*tert*-butyl-4'-hydroxyphenyl) propionate, other compounds such as thioethers, e.g. distearyl 3,3'-thiodipropionate, organic phosphates such as TOF (tris-(2-ethylhexyl) phosphate), silicones such as Dynasilan® Glymo, and mixtures thereof.

Substances which are quite particularly preferred include TOF, triphenylphosphine, Irganox® 1222, tetrakis(2,4-di-*tert*-butylphenyl)-4,4'-biphenylene diphosphonite (Irgafos® PEPQ), octadecyl-3-(3',5'-di-*tert*-butyl-4'-hydroxyphenyl) propionate

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(Irganox® 1076), tris(2,4-di-tert-butyl-phenyl) phosphite (Irgafos® 168), as well as Anox® TB123 (a mixture of octadecyl-3-(3',5'-di-tert-butyl-4'-hydroxyphenyl) propionate, tris(2,4-di-tert-butyl-phenyl) phosphite and distearyl 3,3'-thiodipropionate) (a product of Great Lakes Chemical Corp. Lafayette, IN, USA) Anox® TB331 (a mixture of tris(2,4-di-tert-butyl-4-hydroxyhydrocinnamato)methane, tris(2,4-di-tert-butyl-phenyl) phosphite and distearyl 3,3'-thiodipropionate) (a product of Great Lakes Chemical Corp. Lafayette, IN, USA), and also Irganox® HP2921 (a mixture of octadecyl-3-(3',5'-di-tert-butyl-4'-hydroxyphenyl) propionate, tris(2,4-di-tert-butyl-phenyl) phosphite and Irganox® HP136) (a product of Ciba Spezialitätenchemie, Basle).

The antioxidants are preferably each used in amounts between 0.001 % by weight and 10 % by weight, more preferably between 0.01 % by weight and 0.1 % by weight and most preferably between 0.02 and 0.06 % by weight.

UV absorbers which are suitable in addition according to the invention are described in EP 0 839 623 A1 and EP 0 500 496, for example.

Derivatives of benzotriazole, derivatives of benzophenone, and, under some circumstances, other compounds such as arylated cyanoacrylates, are particularly suitable.

Substances which are particularly preferred according to the invention as UV absorbers include hydroxy-benzotriazoles, such as 2-(3',5'-bis-(1,1-dimethylbenzyl)-2'-hydroxy-phenyl)-benzotriazole (Tinuvin® 234, Ciba Spezialitätenchemie, Basle), 2-(2'-hydroxy-5'-(*tert*-octyl)-phenyl)-benzotriazole (Tinuvin® 329, Ciba Spezialitätenchemie, Basle), 2-(2'-hydroxy-3'-(2-butyl)-5'-(*tert*-butyl)-phenyl)-benzotriazole (Tinuvin® 350, Ciba Spezialitätenchemie, Basle), bis-(3-(2H-benztriazolyl)-2-hydroxy-5-*tert*-octyl)methane (Tinuvin® 360, Ciba Spezialitätenchemie, Basle), 2-(4-hexoxy-2-hydroxyphenyl)-4,6-diphenyl-1,3,5-triazine (Tinuvin® 1577, Ciba Spezialitätenchemie, Basle), as well as the

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benzophenone      2,4-dihydroxy-benzophenone      (Chimasorb22®,      Ciba  
Spezialitätenchemie, Basle).

The UV absorbers are preferably each used in amounts between 0.001 % by weight  
5 and 10 % by weight, preferably between 0.01 % by weight and 5 % by weight, more  
preferably 0.01 % by weight and 1 % by weight, most preferably between 0.1-1 % by  
weight and most preferably in particular between 0.2 and 0.6 % by weight.

Other additives may optionally be used, such as the flame retardants, fillers, foaming  
10 agents, colorants, pigments, optical brighteners and nucleating agents, etc., which are  
known in the literature. These are preferably each contained in amounts of up to 5 %  
by weight, preferably 0.01 to 5 % by weight with respect to the total mixture, most  
preferably 0.01 % by weight to 1 % by weight with respect to the amount of plastics  
material. Mixtures of these additives are also suitable.

15 All common antistatic agents can of course be added in addition to the mixture  
without contravening the teaching according to the invention. The use of these  
substances is not essential, however. Suitable antistatic agents are cited in Gächter,  
Müller, "Plastic Additives", 4th Ed. Munich 1996, pages 749 to 773.

20 Transparent thermoplastics, which are most preferably polymers of ethylenically  
unsaturated monomers and/or condensation polymers of bifunctional reactive  
compounds, are preferably used as the transparent plastics material.

25 Plastics materials which are particularly suitable include polycarbonates or  
copolycarbonates based on diphenols, poly- or copolyacrylates and poly- or  
copolymethacrylates such as poly- or copolymer methyl methacrylate, and copolymers of  
styrene such as transparent polystyrene-acrylonitrile (SAN), as well as transparent  
cycloolefines, condensation polymers or copolymers of terephthalic acid, such as  
30 poly- or copolyethylene terephthalate (PET or COPET) or glycol-modified PET  
(PETG).

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One skilled in the art will achieve excellent results with polycarbonates or copolycarbonates.

Thermoplastic, aromatic polycarbonates in the sense of the present invention include  
5 both homopolycarbonates and copolycarbonates; these polycarbonates can be linear or branched in the known manner.

These polycarbonates are produced in the known manner from diphenols and carbonic acid derivatives, optionally using chain terminators and optionally using branching  
10 agents.

Details of the production of polycarbonates have been recorded in many patent documents for about 40 years. Reference is made here, simply by way of example, to Schnell, "Chemistry and Physics of Polycarbonates", Polymer Reviews, Volume 9,  
15 Interscience Publishers, New York, London, Sydney 1964, to D. Freitag, U. Grigo, P.R. Müller, H. Nouvertne', BAYER AG, "Polycarbonates" in the Encyclopedia of Polymer Science and Engineering, Volume 11, Second Edition, 1988, pages 648-718, and finally to Drs. U. Grigo, K. Kirchner and P.R. Müller: "Polycarbonates" in Becker/Braun, Kunststoff-Handbuch, Volume 3/1, Polycarbonates, Polyacetals,  
20 Polyesters , Cellulose Esters, Carl Hanser Verlag Munich, Vienna 1992, pages 117-299.

Examples of suitable diphenols for the production of polycarbonates include hydroquinone, resorcinol, dihydroxydiphenyls, bis-(hydroxyphenyl)-alkanes,  
25 bis(hydroxyphenyl)-cycloalkanes, bis-(hydroxyphenyl) sulphides, bis-(hydroxyphenyl) ethers, bis-(hydroxyphenyl) ketones, bis-(hydroxyphenyl) sulphones, bis-(hydroxyphenyl) sulphoxides and a',a'-bis-(hydroxyphenyl)-diisopropylbenzenes, as well as compounds thereof which comprise alkylated and halogenated nuclei.

30 The preferred diphenols are 4,4'-dihydroxydiphenyl, 2,2-bis-(4-hydroxyphenyl)-propane, 2,4-bis-(4-hydroxyphenyl)-2-methylbutane, 1,1-bis-(4-hydroxyphenyl)-p-diiso-propylbenzene, 2,2-bis-(3-methyl-4-hydroxyphenyl)-propane, 2,2-bis-(3-chloro-

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4-hydroxyphenyl)-propane, bis-(3,5-dimethyl-4-hydroxyphenyl)-methane, 2,2-bis-(3,5-dimethyl-4-hydroxyphenyl)-propane, bis-(3,5-dimethyl-4-hydroxyphenyl)-sulphone, 2,4-bis-(3,5-dimethyl-4-hydroxyphenyl)-2-methylbutane, 1,1-bis-(3,5-dimethyl-4-hydroxy-phenyl)-p-diisopropylbenzene, 2,2-bis-(3,5-dichloro-4-hydroxy-phenyl)-propane, 2,2-bis-(3,5-dibromo-4-hydroxyphenyl)-propane and 1,1-bis-(4-hydroxyphenyl)-3,3,5-trimethyl-cyclohexane.

Diphenols which are particularly preferred are 2,2-bis-(4-hydroxyphenyl)-propane, 2,2-bis-(3,5-dimethyl-4-hydroxyphenyl)-propane, 2,2-bis-(3,5-dichloro-4-hydroxy-phenyl)-propane, 2,2-bis-(3,5-dibromo-4-hydroxyphenyl)-propane, 1,1-bis-(4-hydroxyphenyl)-cyclohexane and 1,1-bis-(4-hydroxyphenyl)-3,3,5-trimethylcyclohexane.

These and other suitable diphenols are described, for example, in US Patents 3 028 15 635, 2 999 835, 3 148 172, 2 991 273, 3 271 367, 4 982 014 and 2 999 846, in DE-OS 1 570 703, 2 063 050, 2 036 052, 2 211 956 and 3 832 396, in French Patent 1 561 518, in the monograph by H. Schnell, "Chemistry and Physics of Polycarbonates", Interscience Publishers, New York 1964, and in Japanese laid-open Patent Specifications 62039/1986, 62040/1986 and 105550/1986.

20

In the case of homopolycarbonates, only one diphenol is used, and in the case of copolycarbonates a plurality of diphenols is used.

25

Examples of suitable carbonic acid derivatives include phosgene or diphenyl carbonate.

30

Suitable chain terminators include both monophenols and monocarboxylic acids. Suitable monophenols include phenol itself, alkylphenols such as cresols, p-tert.butyl-phenol, p-n-octylphenol, p-iso-octylphenol, p-n-nonylphenol and p-isobornylphenol, halogenated phenols such as p-chlorophenol, 2,4-dichlorophenol or p-bromophenol, and 2,4,6-tribromophenol 2,4,6-triiodophenol, p-iodophenol and mixtures thereof.

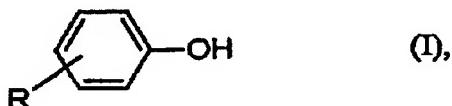
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The preferred chain terminator is p-tert.-butyl phenol.

Suitable monocarboxylic acids include benzoic acid, alkylbenzoic acids and halogenated benzoic acids.

5

The preferred chain terminators include phenols of formula (I)



wherein

- 10 R is hydrogen, tert.-butyl or a branched or unbranched C<sub>8</sub> and/or C<sub>9</sub> alkyl radical.

The amount of chain terminator which is used ranges from 0.1 mol % to 5 mol % with respect to the moles of diphenols used in each case. The chain terminator can be added before, during or after phosgenation.

15

Suitable branching agents are the trifunctional compounds, or compounds with a functionality greater than three, which are known in polycarbonate chemistry, particularly those which comprise three or more than three phenolic OH groups.

- 20 Examples of suitable branching agents include phloroglucinol, 4,6-dimethyl-2,4,6-tri-(4-hydroxyphenyl)-heptene-2, 4,6-dimethyl-2,4,6-tri-(4-hydroxyphenyl)-heptane, 1,3,5-tri-(4-hydroxyphenyl)-benzene, 1,1,1-tri-(4-hydroxyphenyl)-ethane, tri-(4-hydroxyphenyl)-phenylmethane, 2,2-bis-[4,4-bis-(4-hydroxyphenyl)-cyclohexyl]-propane, 2,4-bis-(4-hydroxyphenyl-isopropyl)-phenol, 2,6-bis-(2-hydroxy-5'-methyl-25 benzyl)-4-methyl-phenol, 2-(4-hydroxyphenyl)-2-(2,4-dihydroxyphenyl)-propane, esters of hexa-(4-(4-hydroxy-phenyl-isopropyl)-phenyl)-orthoterephthalic acid, tetra-(4-hydroxyphenyl)-methane, tetra-(4-(4-hydroxyphenyl-isopropyl)-phenoxy)-methane and 1,4-bis-(4',4''-dihydroxy-triphenyl)-methyl)-benzene, as well as 2,4-dihydroxy-

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benzoic acid, trimesic acid, cyanuric chloride and 3,3-bis-(3-methyl-4-hydroxyphenyl)-2-oxo-2,3-dihydroindole.

The amount of branching agents which are optionally used ranges from 0.05 mol % to  
5 2 mol %, again with respect to the moles of diphenols used in each case.

The branching agents can either be present initially with the diphenols and chain  
terminators in the aqueous alkaline phase, or can be added dissolved in an organic  
solvent before phosgenation. For a transesterification process, the branching agents  
10 are used together with the diphenols.

All these measures for the production of thermoplastic polycarbonates are familiar to  
one skilled in the art.

15 It is possible, in order to achieve improved compositions, for the thermoplastic  
materials, preferably poly- and copolycarbonates, to contain the additives which are  
usually present, such as flame retardants, fillers, foaming agents, colorants, pigments,  
optical brighteners, transesterification catalysts and nucleating agents, etc., preferably  
in amounts of up to 5 % by weight in each case, preferably 0.01 to 5 % by weight with  
20 respect to the total mixture, most preferably 0.01 % by weight to 1 % by weight with  
respect to the amount of plastics material.

The polymer compositions which are obtained in this manner can be converted by  
customary methods, such as hot pressing, spinning, extrusion or injection moulding  
25 for example, into moulded articles such as parts of toys, fibres, films, strips, sheeting,  
webbed sheeting, vessels, tubes and other sections. The polymer compositions can  
also be processed to form cast films. Therefore, the present invention further relates to  
the use of the polymer compositions according to the invention for the production of  
moulded articles. The use of multi-layer systems is also of interest.

30 For this application, the polymer composition according to the invention is deposited  
as a thin layer on a moulded article made of a polymer. Deposition can be effected

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simultaneously with or immediately after the moulding of the basic body, e.g. by coextrusion or multi-component injection moulding. Deposition can also be effected on the finished moulded base body, e.g. by lamination with a film or by coating with a solution.

5

The polycarbonate moulding compositions according to the invention can be processed to form mouldings, for example by extruding the polycarbonate, which is isolated in the known manner, to form granules, and by processing said granules, optionally after adding the aforementioned additives, by injection moulding to form  
10 various articles in the known manner.

Mouldings made from the polycarbonate moulding compositions according to the invention can be used in a broad range of applications, particularly in situations where the take-up of dust is undesirable for the aforementioned reasons. One particularly  
15 suitable application is the use thereof in optical data storage media such as CDs, others include automobile components such window glass elements, plastics lens covers, and also the use thereof for extruded sheeting, such as solid sheeting, double webbed sheeting or multi-webbed sheeting, optionally with one or more coextruded layers also, as well as the use thereof for injection moulded parts such as food  
20 containers, components of electrical appliances, in spectacle lenses or for decorative objects.

The polycarbonate moulding compositions according to the invention can also be blended with customary other polymers. Transparent plastics are particularly suitable  
25 in this respect. Transparent thermoplastics are preferably used as the transparent plastics, and most preferably comprise polymers of ethylenically unsaturated monomers and/or condensation polymers of bifunctional reactive compounds.

Plastics which are particularly suitable for these mixtures include poly- or  
30 copolyacrylates and poly- or copolymethacrylates such as poly- or copolymethyl methacrylate, and also include copolymers of styrene in particular, such as transparent polystyrene-acrylonitrile (SAN). Others include transparent cycloolefines, and

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condensation polymers or copolymers of terephthalic acid, such as poly- or copolyethylene terephthalate (PET or COPET) or glycol-modified PET (PETG).

Examples

- Unless stated otherwise, an additive-free, unstabilised polycarbonate (Makrolon® 2808 manufactured by Bayer AG, Leverkusen) with an average molecular weight of about 5 30,000 ( $M_w$  as determined by GPC), solution viscosity:  $\eta=1.293$ , was compounded at 340°C in a twin-shaft extruder with the stated amount of additive and was subsequently granulated. Rectangular panels (155 mm x 75 mm x 2 mm) were subsequently injection moulded from the granules.
- 10 In order to investigate the take-up of dust in a laboratory test, the injection moulded panels were exposed to an atmosphere containing swirled-up dust. A 2 litre beaker containing a triangular magnetic stirrer bar of length 80 mm was filled to a height of 1 cm with the dust concerned. The dust was swirled up by means of a magnetic stirrer. After stopping the stirrer, the specimen was exposed to this dust atmosphere for 7 15 seconds. Depending on the specimen used, a greater or lesser amount of dust was deposited on the specimen. The transmission and haze were subsequently determined as specified by ASTM D 1003, using a Haze-Gard Plus instrument manufactured by BYK-Gardner GmbH, D-82538 Geretsried. If the dust deposition was non-uniform, the mean value of a plurality of measurements was determined. The transmission and 20 haze were measured at 18 points which were distributed uniformly in the form of a 6 x 3 grid on the rectangular panel. Carbon dust proved useful as the dust (the dust used here was 20 g of activated carbon supplied by Riedel-de Haen, Seelze, Germany, Item No. 18003), because effects and differences could be identified more clearly and were easier to measure than when conventional household dust was used.
- 25 Furthermore, the increase in weight of the panels was measured after their exposure to dust. A conventional Mettler Toledo AE200 laboratory balance was used (Table 3).

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The dust formations in Table 2 were evaluated by eye. Panels which exhibited intricate dust formations or high contrast were assessed as negative (-). Those with uniform dust formations of large area were assessed as (+).

5 **Table 1:**

Examples of additives which attracted less dust when incorporated in moulding materials based on Makrolon® 2808 and injection moulded to form panels.

Ex.	Additive	Trans-mission	Haze
1	0.025 % TPP, 0.3 % Ceraphyl® 494, 0.3 % Tinuvin® 350	78.6±4.8	4.6±1.6
2	0.05 % Anox® TB331, 0.3 % GMS, 0.3% Tinuvin® 350	83.5±4.3	2.8±1.4
3	0.03 % Anox® TB123, 0.3 % Grinstedt® PGMS SPV, 0.5 % Edenol® B35, 0.3 % Tinuvin® 329	78.3±4.7	4.9±3.5
Comparative example	no additives	76.8±5.7	5.6±2.4

10 **Table 2:**

Examples of additives which formed quite sheet-like dust formations when incorporated in moulding compositions and injection moulded to form panels (+ sheet-like dust formations, - intricate dust formations)

Ex.	Additive	Dust formations
Comparative example 1	Makrolon® 2808 without additives	-
Comparative example 2	Makrolon® CD2005 without additives	-
Comparative Example 3	0.03 % Irganox® 1076, 0.3 % PETS, 0.3 % Tinuvin® 350	-

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Ex.	Moulding composition	Dust formations
Comparative ex. 4	Makrolon® DPL-1816 without additives	-
1	0.025 % TPP, 0.3 % GMS, 0.3 % Tinuvin® 350	-
2	0.025 % TPP, 0.3 % Grinstedt, 0.3 % Tinuvin® 350	+
3	0.025 % TPP, 0.3 % Loxiol® EP218, 0.3 % Tinuvin® 350	-
4	0.025 % TPP, 0.3 % Ceraphyl® 494, 0.3 % Tinuvin® 350	+
5	0.03 % Irgafos® PEPQ, 0.3 % GMS, 0.3 % Tinuvin® 350	-
6	0.03 Irgafos® PEPQ, 0.3 % Grinstedt® PGMS SPV, 0.3 % Tinuvin® 350	-
8	0.03 % Irgafos® PEPQ, 0.3 % Loxiol® EP218, 0.3 % Tinuvin® 350	+
9	0.03 % Irganox® 1222, 0.3 % GMS, 0.3 % Tinuvin® 350	+
10	0.03 % Irganox® 1222, 0.3 % PETS, 0.3 % Tinuvin® 350	+
11	0.03 % Irganox® 1222, 0.3 % Grinstedt® PGMS SPV, 0.3 % Tinuvin® 350	+
12	0.03 % Irganox® 1222, 0.3 % Loxiol® EP218, 0.3 % Tinuvin® 350	-
13	0.03 % Irganox® 1222, 0.3 % Ceraphyl® 494, 0.3 % Tinuvin® 350	-
14	0.03 % Irganox® 1222, 0.3 % Grinstedt® PS102, 0.3 % Tinuvin® 329	+
15	0.03 % TOF, 0.3 % GMS, Q.3 % Tinuvin® 350	-
17	0.03 % Irganox® HP2921, 0.3 % GMS, 0.3 % Tinuvin® 350	+
18	0.03 % Irganox® HP2921, 0.3 % PETS, 0.3 % Tinuvin® 350	+
19	0.03 % Irganox® HP2921, 0.3 % Grinstedt® PGMS SPV, 0.3% Tinuvin® 350	-
20	0.03 % Irganox® HP2921, 0.3 % Loxiol® EP218, 0.3 % Tinuvin® 350	+
22	0.05 % Anox® TB331, 0.3 % Loxiol® P728, 0.3 % Tinuvin® 350	+
Ex.	Moulding composition	Dust formations

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23	0.05 % Anox® TB331, 0.3 % Loxiol® VPG 2571, 0.3 % Tinuvin® 350	+
24	0.05 % Anox® TB331, 0.3 % Ceraphyl® 791, 0.3% Tinuvin® 350	+
25	0.03 % Anox® TB123, 0.3% GMS, 0.3% Tinuvin® 350	+
26	0.03 % Anox® TB123, 0.3 % Grinstedt® PGMS SPV, 0.3 % Tinuvin® 329	+
27	0.03 % Anox® TB123, 0.3 % Loxiol® EP218, 0.3 % Tinuvin® 350	-
29	0.03 % Anox® TB123, 0.3 % Ceraphyl® 494, 0.3 % Tinuvin® 329	+
30	0.05 % Anox® TB331, 0.3 % GMS, 0.3 % Tinuvin® 350	+
31	0.03 % Anox® TB331, 0.3 % Grinstedt® PGMS SPV, 0.3 % Tinuvin® 350	-
32	0.05 % Anox® TB331, 0.3 % Loxiol® EP218, 0.3 % Tinuvin® 350	+
33	0.05 % Anox® TB331, 0.3 % PETS, 0.3 % Tinuvin® 350	+
34	0.05 % Anox® TB331, 0.3 % Ceraphyl® 494, 0.3% Tinuvin® 350	+
35	0.05 % TPP, 0.3 % PETs, 0.5 % Edenol® B35, 0.3 % Tinuvin® 329	+
36	0.03 % Irganox® 1222, 0.3 % Grinstedt® PGMS SPV, 0.5 % Edenol® B35, 0.3 % Tinuvin® 350	+
37	0.03 % TOF, 0.3 % Grinstedt® PGMS SPV, 0.5 % Edenol® B35, 0.3 % Tinuvin® 350	+
38	0.03 % Anox® TB123, 0.3 % Grinstedt® PGMS SPV, 0.5 % Edenol® B35, 0.3 % Tinuvin® 329	+
39	0.03 % Anox® TB331, 0.3 % PETs, 0.5 % Edenol® B35, 0.3 % Tinuvin® 329	+

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Ex.	Moulding composition	Dust formations
42	0.05 % Anox® TB331, 0.3 % PETS, 0.5 % Edenol® W3105, 0.3 % Tinuvin® 350	+
43	0.03 % Irganox® 1222, 0.3 % PETS, 0.5 % Edenol® B316, 0.3 % Tinuvin® 329	+
44	0.03 % Anox® TB123, 0.3 % Grinstedt® PGMS SPV, 0.5 % Edenol® B316, 0.3 % Tinuvin® 329	+
45	0.03 % Anox® TB123, 0.3 % PETS, 0.5 % Edenol® B316, 0.3 % Tinuvin® 329	+
46	0.03 % Irganox® 1222, 0.3 % Grinstedt® PGMS SPV, 0.3 % Edenol® B316, 0.3 % Tinuvin® 329	+
47	0.03 % Irganox® 1222, 0.3 % Grinstedt® PGMS SPV, 0.3 % Edenol® B316, 0.3 % Tinuvin® 329	+

**Table 3:**

Increase in weight of rectangular panels after exposure to carbon dust

5

Ex.	Moulding composition	mg carbon dust
Comp. ex. 1	Makrolon® 2808	7
Comp. ex. 2	Makrolon® A12647	7
1	0.025 % TPP, 0.3 % Ceraphyl® 494, 0.3 % Tinuvin® 350	6
2	0.03 % Anox® TB123, 0.3 % Grinstedt® PGMS SPV, 0.5 % Edenol® B35, 0.3 % Tinuvin® 329	3
3	TPP/Grinstedt PGMS SPV/Tin 350	6
4	TPP/Loxiol 218/Tin 350	7
5	Irgafos PEPQ/Grinstedt PGMS SPV/Tin 350	9
6	Irgafos PEPQ/Grinstedt PGMS SPV/Tin 350	8
7	Irgafos PEPQ/Loxiol EP218/Tin 350	8

Ex.	Moulding composition	mg carbon dust
8	Irganox 1076/ Grinstedt PGMS SPV/Tin 350	8
9	Irganox 1222/ Grinstedt PGMS SPV/Tin 350	9
10	Irgafos 168/ PETG/Tin 350	8
11	Irganox 1222/ Ceraphyl 494/Tin 350	5
12	Irganox HP2921/Grinstedt PGMS SPV/Tin 350	5
13	Irganox HP2921/Loxiol EP218/Tin 350	6

Tables 1-3 clearly show that mouldings made of the moulding compositions according to the invention attract less dust, exhibit better transmission after exposure to dust and result in dust formations which are visually more pleasing and more sheet-like compared with mouldings made from conventional moulding compositions.

Claims

1. Polycarbonate moulding compositions which contain at least one antioxidant and a demoulding agent, characterised in that the antioxidant contains at least 5 one stabiliser from the group comprising

- TPP, tetrakis(2,4-di-*tert*-butylphenyl)-4,4'-biphenylene diphosphonite, Irganox® 1222, octadecyl-3-(3',5'-di-*tert*-butyl-4'-hydroxyphenyl) propionate, Irganox® HP2921, Anox® TB331, Anox® TB123 or a mixture thereof, preferably in amounts between 0.001 and 1 % by weight, most preferably between 0.01 and 0.1 % by weight,

10 and the demoulding agent contains at least one substance from the group comprising

15

- polyols which are completely or partially esterified with a linear or branched fatty acid,

20 wherein glycerol, ethylene glycol, propylene glycol, pentaerythritol or fatty alcohols are preferably used as polyols.

25 2. Polycarbonate moulding compositions according to claim 1, characterised in that Ceraphyl® 494, GMS, Grinstedt® PGMS SPV, Loxiol® EP218, pentaerythritol tetrastearate (PETS), isocetyl stearyl stearate, Edenol® B35, Edenol® B316, Edenol® W310S or a mixture thereof are used as demoulding agents, preferably in amounts between 0.01 and 5 % by weight, most preferably between 0.1 and 1 % by weight.

30 3. Polycarbonate moulding compositions according to at least one of the preceding claims, characterised in that a mixture of PETS and an Edenol or a mixture of Grinstedt and an Edenol is used as a demoulding agent.

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4. Polycarbonate moulding compositions according to at least one of the preceding claims, characterised in that at least one derivative of benzotriazole and/or at least one derivative of benzophenone is contained in addition as a UV stabiliser.
5. Polycarbonate moulding compositions according to claim 4, characterised in that 2-(2'-hydroxy-3'-(2-butyl)-5'-(*tert*-butyl)-phenyl)-benzotriazole (Tinuvin® 350), 2-(2'-hydroxy-5'-(*tert*-octyl)-phenyl)-benzotriazole, bis-(3-(2H-benzotriazolyl)-2-hydroxy-5-*tert*-octyl)methane, 2-(4-hexoxy-2-hydroxy-phenyl)-4,6-diphenyl-1,3,5-triazine or a mixture thereof are used as UV stabilisers, preferably in amounts between 0.01 and 10 % by weight, most preferably between 0.1 and 1 % by weight.
6. Polycarbonate moulding compositions according to at least one of the preceding claims, characterised in that epoxidised oils, such as epoxidised linseed oil or epoxidised soya oil or mixtures thereof, are used in addition, preferably in amounts between 0.01 and 10 % by weight, most preferably between 0.1 and 1 % by weight.
7. Polycarbonate moulding compositions according to at least one of the preceding claims, characterised in that octadecyl-3-(3',5'-di-*tert*.-butyl-4'-hydroxyphenyl propionate (Irganox® 1076) is contained.
8. Polycarbonate moulding compositions according to at least one of the preceding claims, characterised in that a commercially available antistatic agent is also contained in addition, preferably in amounts between 0.001 and 3 % by weight, more preferably in amounts between 0.01 and 1.5 % by weight, most preferably in amounts between 0.1 and 1 % by weight.
9. The use of moulding compositions according to any one of claims 1 to 8 for the production of moulded articles.

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10. The use of moulding compositions according to any one of claims 1 to 8 for the production of optical data storage media.
11. The use of moulding compositions according to any one of claims 1 to 8 for 5 the production of extruded mouldings.
12. The use of moulding compositions according to any one of claims 1 to 8 for the production of multi-layer systems.
- 10 13. The use of moulding compositions according to any one of claims 1 to 8 for the production of injection moulded bodies.
14. The use of moulding compositions according to any one of claims 1 to 8 for 15 the production of automobile window glasses, lighting elements such as plastics lens covers, for example, or for other automobile parts.
15. The use of moulding compositions according to any one of claims 1 to 8 for the production of injection moulded parts, such as food containers, components of electrical appliances or decorative objects.
- 20 16. The use of moulding compositions according to any one of claims 1 to 8 for the production of spectacles.
17. Mouldings produced from polycarbonate moulding compositions as defined in 25 claims 1 to 9.